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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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BROOKS KUSHMAN P.C. 1000 TOWN CENTER TWENTY-SECOND FLOOR SOUTHFIELD, MI 48075			EXAMINER ZIMMER, ANTHONY J	
			ART UNIT 1709	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/501,369

Applicant(s)

AUNER, NORBERT

Examiner

Anthony J. Zimmer

Art Unit

1709

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 28-53 is/are pending in the application.
- 4a) Of the above claim(s) 42-53 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 28-41 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>07/14/2007</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Election/Restrictions

1. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claim(s) 28-41, drawn to a process for preparing amorphous silicon particles.

Group II, claim(s) 42, drawn to a process for purifying silicon metal.

Group III, claim(s) 43-53, drawn to a process for preparing an organosilicon compound.

2. The inventions listed as Groups I, II, and III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the common technical feature in all groups is the process of claim 28:

A process for preparing amorphous silicon particles comprising:
reducing a halosilane, organohalosilane, salt thereof, or mixture thereof with a metal or metal compound as a reducing agent in an organic solvent, wherein when the halogen of said halosilane or organohalosilane is Cl, Br, or I, said organic solvent is an apolar organic solvent.

However, this process cannot be a special technical feature under PCT Rule 13.1

because the process is shown in the prior art. WO 01/14250 teaches a process that

produces amorphous silicon comprising reducing a halosilane with a metal in a solvent,

Art Unit: 1709

see WO 01/14250 claim 1 part (a). Furthermore WO 01/14250 teaches halosilanes or organosilanes wherein the halosilane or organosilane is a compound of Br, Cl, I, or F, see WO 01/14250 claim 3. WO 01/14250 also teaches organic and nonpolar solvents, see claims 10 and 13 of WO 01/14250. Therefore, Groups I, II, and III do not have a corresponding special technical feature and therefore lack unity.

3. During a telephone conversation with William Conger on 8 August 2007 a provisional election was made with traverse to prosecute the invention of Group I, claims 28-41. Affirmation of this election must be made by applicant in replying to this Office action. Claims 42-53 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Priority

4. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed in German parent Application Numbers 102-17-125.4, 102-17-126.2, and 102-17-140.8, filed on 17 April 2002.

Information Disclosure Statement

5. The information disclosure statement (IDS) submitted on 14 July 2004 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Objections

6. Claim 28 is objected to because of the following informalities: Chlorine is referred to as "C1", a suggested correction would be "Cl". Appropriate correction is required.

Claim 34 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. In the case when part (b) is chosen, silicon tetrafluoride is a fluorine compound of which the respective halosilane was not included in parent claim 28.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 28-29, 34-36, and 39 are rejected under 35 U.S.C. 102(b) as being anticipated by Harwell (WO 01/14250, hereafter WO'250).

Claim 28 is drawn to a process for preparing amorphous silicon particles, comprising:
reducing a halosilane, organohalosilane, salt thereof, or mixture thereof with a metal or metal compound as a reducing agent in an organic solvent,

Claim 29 is drawn to the process of claim 28, wherein said halosilane comprises silicon tetrachloride.

Claim 34 is drawn to the process of claim 28 wherein said reducing agent comprises at least one metal from Group 1 or Group 2 of the Periodic Table.

Claim 35 is drawn to the process of claim 28, wherein said reducing agent comprises sodium metal.

Claim 36 is drawn to the process of claim 28 wherein said reducing agent comprises a dispersion of solid metal particles in an organic solvent.

Claim 39 is drawn to the process of claim 28, wherein said reducing comprises reducing under reflux in the organic solvent.

WO 01/14250 teaches a process that produces amorphous silicon comprising reducing a halosilane with a metal in a solvent under reflux, see WO 01/14250 claim 24 part (a). Furthermore WO 01/14250 teaches using halosilanes or organosilanes wherein the halosilane or organosilane is a compound of Br, Cl, I, or F, see WO 01/14250 claim 26. WO 01/14250 also teaches organic and nonpolar (apolar) solvents, see claims 31, 33, and 34 (where diethyl ether is a nonpolar (apolar) organic solvent). WO'250 teaches using silicon tetrachloride as a halosilane, see claim 27 of WO'250. Furthermore WO'250 teaches using sodium metal (a Group 1 metal), see claim 28. One of ordinary skill in the art at the time of the invention would have recognized the inherency of the reducing agent being deployed in a dispersion in an organic polar solvent. Diethyl ether, a nonpolar organic solvent, is used under reflux. The boiling point of diethyl ether and the temperature under which the reflux would necessarily run is 34.5°C. At this temperature sodium metal is in the solid state (mp = 95°C), so the solid sodium would necessarily be a solid dispersed in the solvent.

Therefore Claims 28-29, 34-36, and 39 are rejected under 35 U.S.C. 102(b) as being anticipated by Harwell.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. Claims 28, 30-33, 37-38, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Häyhä (US4756896, hereafter US'896) in view of Harwell (WO 01/14250, hereafter WO'250).

Claim 30 is drawn to claim 28 (see the limitations of claim 28 above) wherein said salt to be reduced is hexafluorsilicate salt.

Art Unit: 1709

Claim 31 is drawn to the process of claim 28, further comprising first preparing by one of the following:

- a) where the halosilane comprises silicon tetrafluoride,
 - i) reacting silica with chlorine in the presence of a reducing agent to form silicon tetrachloride,
 - ii) reacting silicon with chlorine or a chlorine compound to form silicon tetrachloride;
 - iii) separating silicon tetrafluoride from the product of a Muller-Rochow synthesis of chlorosilanes,
- b) where the halosilane comprises silicon tetrafluoride,
 - i) reacting silica or a metal silicate with HF or a fluoride of at least one metal selected from the group consisting of the Group 1 and Group 2 metals of the Periodic Table of the Elements to yield silicon tetrafluoride and water or
 - ii) decomposing a hexafluorosilicate metal salt to generate silicon tetrafluoride and a metal fluoride.

US'896 teaches reducing sodium silicon fluoride (a hexafluorosilicate salt), see claim 11, by heating it to produce silicon tetrafluoride gas and sodium fluoride, and reducing with an alkali or alkaline metal dispersed in a liquid intermediate agent, see claim 10. Mineral oil (a nonpolar, organic solvent) in particular is used, see Example 1. US'896 fails to teach using a halosilane of chlorine, bromine, or iodine.

However, it would have been obvious to one of ordinary skill in the art to modify US'896 in view of WO'250 as WO'250 teaches using silanes or organosilanes of any halogen—Iodine, Fluorine, Bromine, or Chlorine—(see page 18 lines 3-4 or WO'250). It is known in the art that any halosilane can be reduced to produce amorphous silicon

Art Unit: 1709

(see WO'250 page 18 lines 3-4). Applicant even uses fluorine successfully in applicant's own examples.

Thus, it would have been obvious to a person of ordinary skill in the art to try a halosilane of any halogen including iodine, fluorine, and bromine, as a person of ordinary skill has good reason to pursue the known options within his or her grasp.

Claim 32 is drawn to the process of claim 28, wherein a metal is employed as a reducing agent, and said organic solvent is heated to a temperature sufficient to melt said metal.

Claim 33 is drawn to the process of claim 32, wherein said metal in a liquid state and said organic solvent are agitated to form a dispersion of metal.

Claim 37 is drawn to the process of claim 28, wherein said reducing agent comprises fusible metal, and said organic solvent has a boiling point at the pressure under which the process is conducted which is higher than the melting point of the fusible metal.

Claim 38 is drawn to the process of claim 37 which is conducted at atmospheric pressure.

Claim 40 is drawn to the process of claim 28, further comprising separating an amorphous silicon particle product from other reaction components.

US'896 teaches a process of reducing a halosilane (silicon tetrafluoride) in a boiling organic, nonpolar solvent (mineral oil in particular) with molten sodium (or a Group 1 or 2 metal) dispersed and blended (agitated) in the solvent. Furthermore US'896 teaches separating the amorphous silicon products from other reaction components. (see Example 1 and claims 1-19) US'896 does not explicitly teach performing the reaction at atmospheric pressure, but one of ordinary skill in the art at

Art Unit: 1709

the time of the invention would have envisaged that this is the case, as US'896 does not mention performing the reaction under pressure or in a vacuum, and atmospheric pressure is standard operating procedure unless otherwise specified.

US'896 fails to teach using halosilanes wherein the halogen of the halosilane is Cl, Br, or I, as required by claim 28 of the instant application. WO'250 teaches using silicon tetrachloride (or a halosilane of any halogen) to produce amorphous silicon. Since both US'896 and WO'250 teach methods for producing amorphous silicon, it would have been obvious to one of ordinary skill in the art to substitute one reactant for the other (i.e. silicon tetrachloride (or a halosilane of any halogen) for silicon tetrafluoride) to achieve the predictable result of producing amorphous silicon. (see WO'250 page 18 first paragraph)

Therefore, claims 28, 30-33, 37-38, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Häyhä (US4756896) in view of Harwell (WO01/14250).

12. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harwell (WO 01/14250) in view of Kotzsch et al. (US4044109).

Claim 41 is drawn to the process of claim 28 wherein crystalline silicon is the precursor to said halosilane or organosilane. Harwell teaches the process of claim 28 (see 102 rejection above), but fails to teach producing the needed reagent silicon tetrachloride from crystalline silicon.

Art Unit: 1709

However, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Harwell in view of Kotzsch, as Kotzsch teaches a method for silicon tetrafluoride production from elemental (crystalline) silicon.

One would have been motivated to modify Harwell in view of Kotzsch in order to be able to use the crystalline silicon as a source for silicon tetrafluoride, purify the crystalline silicon, and to achieve the predictable result of creating amorphous silicon from crystalline silicon.

Conclusion

13. In sum claims 28-41 are rejected, and no claim is allowed.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anthony J. Zimmer whose telephone number is 571-270-3591. The examiner can normally be reached on Monday - Friday 7:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on 571-272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1709

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ajz

VICKIE Y. KIM
SUPERVISORY PATENT EXAMINER

